REMARKS

Applicants thank Examiner Aughenbaugh for his courteous and congenial telephone interview with the Applicants' representative on July 6, 2005.

Claims 27-30 and 32-37 are pending in the present continuation application.

Claims 1-26 and 31 are canceled.

Claims 27 and 35 are amended to more particularly point out and distinctly claim the invention. Support in the specification for the amendments to claims 27 and 35 are at page 14, lines 19-21. Claim 35 also is amended to recite that the silicon carbide does not have propagating cracks as suggest by the Examiner during the telephone interview. Support for this amendment of claim 35 is at page 10, lines 9-14 of the specification.

Claim 35 also is amended to correct a typographical error. The term "ration" in line 14 should be "ratio".

Claims 36-37 are new. Support in the specification for claim 36 is at page 5, lines 11-14. Support in the specification for new claim 37 is at page 4, lines 20-33, page 8, line 26 to page 9, line 3 and page 13, lines 15-33. New claim 37 is added in view of the comments made in the Advisory Action mailed November 4, 2004. The Examiner suggested that language be added to the claims to point out that the claimed articles are free of cracks.

Claims 27-29 and 32-34 are rejected under 35 U.S.C. §103 as allegedly unpatentable over U.S. 5,783,255 to Suda et al. Applicants respectfully traverse this rejection.

As pointed out at page 2 of the present Office Action, claims 27-29 and 32-34 are rejected for the same reasons as in the previous office Action mailed July 29, 2004. The Office Action alleges that it would have been obvious for the person of skill in the art to make a chemical vapor deposited silicon carbide article as recited in the present claims based on the teachings of Suda et al. because a change in size of an article is generally recognized as being within the level of ordinary skill in the art. The Office Action cites *In re Rose*, 105 U.S.P.Q. 237 (CCPA 1955) to support its allegation.

It is generally known in the ceramic art that ceramic materials such as chemical vapor deposited silicon carbide is not readily size scalable because such materials may crack as the size of the article is increased. This is discussed in the paper entitled "Applications of Chemical Vapor Deposited β-SiC", which is of record. This paper points out that the strength of silicon

carbide articles depend upon the size of the flaw in the material, which in turn depends upon the volume of the material. The larger the size of the article, the greater is the probability of finding a flaw of larger size. This is exemplified in the article. The larger the article, the larger the flaw is expected to be, and the weaker the article. Chemical vapor deposited silicon carbide articles with propagating cracks are undesirable (specification, page 3, lines 14-32).

Although Suda et al. allege that their CVD method enables the formation of crack free chemical vapor deposited silicon carbide articles, the articles disclosed by Suda et al. are directed to small articles with diameters such as 150 mm (which corresponds to an external perimeter of 18.5 inches) and as small as 50 mm (Suda et al., col. 5, lines 22-25 and col. 6, lines 34-36). In contrast, the chemical vapor deposited silicon carbide shells of the presently claimed invention have an external perimeter of 50 inches or greater (claim 27), not 18.5 inches and diameters of 18 inches or greater (claim 36), not 50 mm.

Enclosed with the present Amendment is a Rule 132 Declaration executed by Dr. Jitendra S. Goela a co-inventor of the present application. Dr. Goela has done a great deal of work with chemical vapor deposited silicon carbide materials including size scaling (see paragraph 3 of the Declaration). The Declaration states that increasing the size of ceramic materials such as chemical vapor deposited silicon carbide during synthesis is not generally recognized as being within the level of ordinary skill in the art. This is especially true when the volume of the chemical vapor deposited silicon carbide increases by a factor of 2 or more because as the size of the article increases the strength of the article decreases and stresses increase (see paragraph 7). Increasing the perimeter of a chemical vapor deposited silicon carbide article having a perimeter of 18.5 inches, as disclosed in Suda et al., to at least 50 inches, as recited in present claim 27, would be increasing the size of the article by 2.7 times. Increasing the diameter of a chemical vapor deposited silicon carbide from 50 mm (2 inches) to 18 inches, as in present claim 36, is a size increase of 9 times. The skilled artisan would have expected that to increase the size of the articles in Suda et al. to the size of the silicon carbide articles recited in the present claims would both decrease the strength of the articles and increases stresses. This increases the probability of forming flaws in the silicon carbide. See the enclosed Rule 132 Declaration.

Chemical vapor deposited silicon carbide is a brittle material which is susceptible to flaw induced fracture. The strength of the silicon carbide depends on the size of the flaws and follows

the Weibull distribution (see paragraph 8). As the size of the silicon carbide article increases the probability of forming flaws of increasing size also increases, thus the strength of the article decreases (paragraph 9). As shown in the Declaration to scale a chemical vapor deposited silicon carbide article having a diameter of 2 inches, such as the article disclosed in Suda et al., to one having a diameter increased to 18 inches, as recited in present claim 36, results in a strength decrease in the article by a factor of about $3 = (A_{18}/A_2)^{1/m}$ as determined by the maximum allowable stress equation (see paragraph 17), where σ_{18} is the mean fracture stress for the test specimen (constant), and m is the Weibull modulus for chemical vapor deposited silicon carbide (grown silicon carbide). See Exhibit B of the Declaration. Accordingly, as the size of a 2 inch (50 mm) silicon carbide article is increased to a size of 18 inches the strength of the article decreases by a factor of 3 and the probability of forming larger flaws in the article increases (see paragraph 9).

There are two types of stresses involved in making chemical vapor deposited silicon carbide: 1. growth stresses and 2.stresses due to thermal expansion mismatch (see paragraph 11). As the size of the chemical vapor deposited silicon carbide article increases both the growth stresses and the stresses caused by thermal mismatch increase (see paragraphs 12 and 13). As the stresses increase the probability of flaws also increases (see paragraphs 9 and 10). As pointed out in the declaration in paragraph 14 Suda et al. may have reduced the stresses due to thermal expansion mismatch between the silicon carbide and the carbon substrate on which it is deposited (col. 4, lines 55-58). However, as pointed out in the Declaration (paragraph 14), it is unlikely that the coefficient of thermal expansion (CTE) of the carbon substrate and the silicon carbide deposit match at all temperatures during the cool down from 1400° C until the deposit is removed from the carbon substrate (col. 5, lines 9-26), thus growth stresses would still be present. As the size of the article is increases the growth stresses would increase with decreasing strength of the article. As the article increases in size the size of any flaws would increase as well. Accordingly, increasing the size of a chemical vapor deposited silicon carbide shell would not have been viewed as being within the level of ordinary skill in the art by the skilled artisan (see paragraph 18).

Further, *In re Rose* (copy enclosed) is not applicable to the present application. In *In re Rose* the size issue concerned the size of packages for packaging lumber (wood). The case did

not address the issue of changing the size of an article based on the physical properties of the material from which it was made as in the present application. In *In re Rose*, the Appellant argued that the applied documents, Wheless and Denison, disclosed packages which could be lifted by hand whereas the package of lumber in the claims at issue were of appreciable size and weight such that it had to be handled by a lift truck. The Court concluded that the limitation of size was not patentably significant since at most it related to the size of the article nothing else. There was no issue as to the chemical composition of the article and its physical properties and how the properties affect size.

Further, the Court in *In re Rose* cited the decision from *In re Yount*, 80 U.S.P.Q. 141 (copy enclosed) for the basis of their holding on the issue of size. In *In re Yount*, the issue of size involved the size of paper bags. The issue of how the physical properties of the material out of which the bags were made effect size was never addressed. There was no issue as to the relationship between the type of material and the probability of increasing its size without damage to it. Appellant's bags were of a similar structure as those disclosed in the applied references. The Appellant argued that his bags were much larger in size than those disclosed in the two references. The court pointed out that there was no language in his claims specifying a large bag, and that his specification recited that the invention was also applicable to relatively small bags. The court pointed out that since the Appellant stated in his specification that small bags are equivalent to large bags, there was no invention in size.

In contrast to *In re Rose* and *In re Yount*, increasing the size of a chemical vapor deposited silicon carbide article involves the consideration of the physical properties of the silicon carbide material itself such as the strengths and stresses involved as the size of the article is increased and the potential for flaws to form. No such issues were raised in either case. Additionally, the presently claimed invention recites the size elements in the claims which distinguish the present invention over Suda et al., and the specification of the application does not disclose making articles of small size as disclosed in Suda et al. Accordingly, neither case is applicable to the presently claimed invention; and there would have been no reason or motivation for the person of skill in the art to increase the size of the articles based on the teachings of Suda et al. to make chemical vapor deposited shells as recited in the present claims.

Applicants respectfully request withdrawal of the rejection of claims 27-34 under 35 U.S.C. §103 over U.S. 5,783,255 to Suda et al.

Claim 30 is rejected under 35 U.S.C. §103 as allegedly unpatentable over U.S. 5,783,255 to Suda et al. and further in view of U.S. 5,776,391 to Sibley. Applicants respectfully traverse this rejection.

Claim 30 depends from present claim 27. Claim 27 is patentable over Suda et al. for the reasons discussed above. Accordingly, claim 30 is patentable over Suda et al. alone or in combination with Sibley.

Applicants respectfully request withdrawal of the rejection of claim 30 under 35 U.S.C. §103 over U.S. 5,783,255 to Suda et al. and further in view of U.S. 5,776,391 to Sibley.

Claim 35 is rejected under 35 U.S.C. §103 as allegedly unpatentable over U.S. 5,783,255 to Suda et al. Applicants respectfully traverse this rejection.

Claim 35 is patentable over Suda et al. for the same reasons as the other claims as discussed above. In addition, Suda et al. do not teach or suggest the method steps recited in present claim 35 to provide a chemical vapor deposited silicon carbide shell without propagating cracks, an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater.

The Office Action alleges that the method steps are not germane to the patentability of the shell itself. Applicants respectfully disagree. An applicant may present claims of varying scope even if it is necessary to describe the claimed product in product-by-process terms. See MPEP §2173.05(p) and *Ex parte Pantzer*, 176 U.S.P.Q. 141 (Bd. App. 1972). The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over applied documents, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See MPEP §2113 and *In re Garnero*, 162 U.S.P.Q. 221, 223 (C.C.P.A. 1979). The steps recited in present claim 35 impart the distinctive structure of the recited product. The isolation device recited in present claim 35 provides a chemical vapor deposited silicon carbide shell having an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater and which may be removed from the mandrel on which it is deposited without the formation of propagating cracks (specification, page 8, line 26 to page 9, line 6, and page 10, lines 5-14). Prior to the presently claimed invention,

portions of the silicon carbide deposit which extended beyond the deposition mandrel had to be broken to release the deposit. This often resulted in propagating cracks throughout the deposit and limited the size of the chemical vapor deposited articles (specification, page 3, lines 14-32). Accordingly, the presently claimed method enabled the formation of a silicon carbide shell having the recited size.

Applicants respectfully request withdrawal of the rejection of claim 35 under 35 U.S.C. § 103(a) as allegedly unpatentable over U.S. 5,783,255 to Suda et al.

Respectfully submitted,

John J. Piskorski
Attorney for Applicants
Registration No. 35,647
Telephone No.: (508) 229-7662
Facsimile No.: (508) 229-0254

Rohm and Haas Electronic Materials, L.L.C.
455 Forest Street
Marlborough, MA 01752